MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

TDS2111 – DATA STRUCTURES AND ALGORITHMS

(All Sections/Groups)

13 OCTOBER 2015
02:30PM – 04:30PM
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 5 pages (including cover page) with 5 structured questions.

2. You must attempt any **FOUR out of FIVE** questions. The distribution of the marks for each question is given.

3. Please print all your answers in the answer booklet provided.

Question 1

(a) What are the value(s) in the initially empty queues *queue1* and *queue2* after each of the following sequence of operations? (4 marks)

```
queue1.enqueue(1)
queue1.enqueue(2)
queue1.dequeue()
queue2.enqueue(3)
queueFront = queue2.getFront()
queue2.enqueue(4)
queue1.enqueue(queueFront)
queue1.enqueue(5)
```

(b) Given the following function:

```
void myfunc( int x, int y)
{
     if (y > 0)
     {
          x++;
          y--;
          cout << x << " " << y << endl;
          myfunc (x, y);
          cout << x << " " << y << endl;
     } // end if
} // end myfunc
```

What are the outputs produced when x = 6 and y = 3? (6 marks)

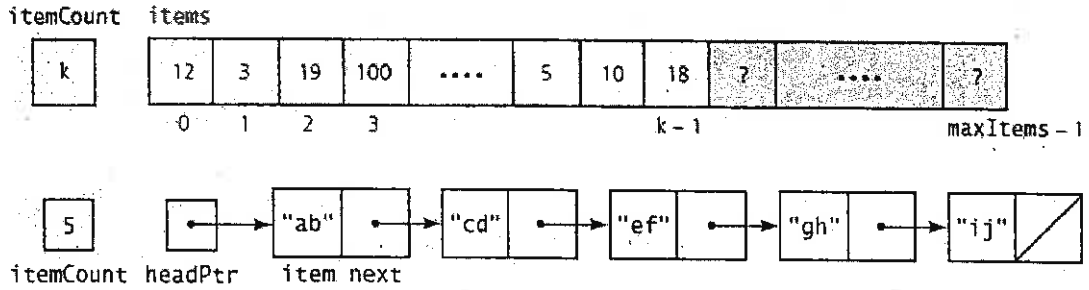
Continued.....

Question 2

(a) Convert the following infix expression to postfix expression. (3 marks)

i. $a + b / c + d$
ii. $a * b + c - d$
iii. $(a + b) * (c - d)$

(b) Given the following diagrams of array-based and linked list-based implementations:



i. Discuss the differences of array-based and linked list-based implementations, based on the size and access time. (2 marks)
ii. Based on the given diagram, what is the usage of '**itemCount**' in both implementations? (1 mark)
iii. Write a C++ definition of a structure called **Record** to represent a node in a linked list that stores a string and a pointer. Name the string as **item**. Name the pointer as **next.** (2 marks)
iv. Complete the following C++ codes that traverse the list to a specific **location** and retrieve **item**. Assume that the pointer 'head' is referencing to a linked list. Every node in the linked list contains an '**item**' and a pointer '**next**'. (2 marks)

```
int main(){
   Record *head;
   head = new Record;

   cur = head;

   // Write your codes in the Answer Booklet

}
```

Continued.....

Question 3

(a) Compare *linear probing*, *quadratic probing*, and *double hashing* in resolving collisions that occur in hashing. (6 marks)

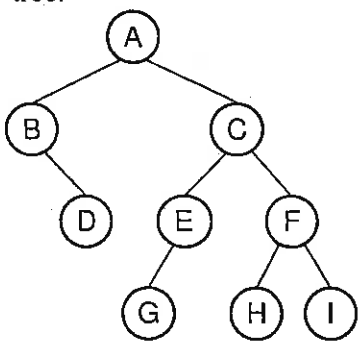
(b) Complete the C++ program below by implementing the insertion sort algorithm. (4 marks)

```
int main(){
    const int size = 5;
    int ary[size] = {3,5,2,6,1};
   //Insertion sort algorithm

  // Write your codes in the Answer Booklet

   for(int i=0; i<size; i++)
      cout << ary[i] << endl;
}
```

```
Sample output:
1
2
3
5
6
```

Question 4

(a) Given the following binary tree.



i. Use the definitions of **full** and **complete** binary tree to prove that the above tree is neither complete nor full. (2 marks)

ii. List the sequence of nodes for **postorder** and **inorder** traversals. (2 marks)

iii. What is the height of the binary tree? (1 mark)

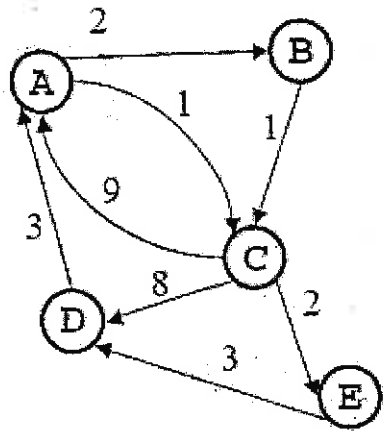
iv. Sketch a diagram to show the array-based representation of this binary tree. (5 marks)

Continued.....

Question 5

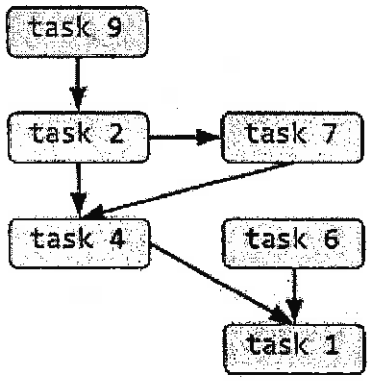
(a) Based on the weighted directed graph as shown below, complete the table with the trace of the shortest path using Dijkstra's algorithm that begins at **vertex C**.

(4 marks)



			weight				
Step	v	vertexSet	[A]	[B]	[C]	[D]	[E]
1	-	C	9	∞	0	8	2
2							
3							
4							
5							

(b) A directed acyclic graph can be used to represent a set of tasks, some of which are prerequisites of the others (shown in figure). An edge indicates that one task must be performed before the other.



i. Describe **TWO** simple algorithms for finding a topological order from the above graph. [*Hint: topSort1, topSort2*] (4 marks)

ii. Give the topological order of the vertices based on one of the algorithms in (b) i. (2 marks)

End of Page